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SPECIFICATION FOR FRONT SURFACE ALUMINIZED MIRRORS

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SPECIFICATION FOR FRONT SURFACE ALUMINIZED MIRRORS

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Indian Standard
SPECIFICATION FOR FRONT SURFACE ALUMINIZED MIRRORS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 27 May 1980, after the draft finalized by the Optical and Mathematical Instruments Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 Although some general requirements of mirrors are already covered in IS : 988-1959*, this standard covers specifically the essential requirements and tests for front surface aluminized mirrors used in optical instruments and projection systems.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies the requirements of front surface aluminized mirrors used in optical instruments and projection systems for wavelengths of light in the visible regions of 400 to 700 nm.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 1399-1959‡ shall apply.

3. MATERIAL

3.1 Polished blanks shall be used which are reasonably free from strains or surface-defects likely to be detrimental to the performance of the mirror or to be a cause of spoiling its appearance unduly. Glasses which have a high soda content should not be used. Where the quality of image is important, as in the case of optical instruments, only glass of optical quality (as specified in **2.2** of IS : 7011-1973*) having the permissible transmission/refraction characteristics commensurate with the design requirements should be used.

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*General requirements for optical components.
†Rules for rounding off numerical values (*revised*).
‡Glossary of terms used in optical technology.

3.2 For optical instruments, where quality of image is an important requirement, glass conforming to grades D_1 and D_2 of IS : 1400-1960† shall be used.

3.3 The cleansing agents used shall be of analytical quality. The purity of aluminium used shall be 99·99 percent.

4. GENERAL REQUIREMENTS

4.1 The film and coating process producing a finished mirror shall cause no damage to the optical surface and shall not introduce any optical defects not inherent in the optical blanks.

4.2 Fine hair lines or other defects which are made more visible by mirroring process on the coated mirror are permissible unless such defects are visible in the field of view of an assembled instrument.

4.3 The mirrors may be anodized or a protective film of magnesium fluoride or an oxide of silicon may be given over aluminium coating unless otherwise specified by the indentor.

4.4 Surface accuracy of the mirror shall be as specified by the indentor.

5. FUNCTIONAL REQUIREMENTS

5.1 The finished mirror shall have not less than 86 percent average reflectivity in the visible region of 400 to 700 nm when tested by the method given in **6.4**.

5.2 There shall be no visible deterioration of the mirror and the decrease in reflectivity shall not exceed 5 percent after the hardness test as specified in **6.5**.

5.3 No part of the aluminium coating shall be removed when subjected to adherence test.

5.4 The finished mirror shall show no evidence of damage after being subjected to the tests given in **6.7**.

---

*Specification for back-silvered mirrors used in instrument industry.

†Specification for optical glass.

5.5 When specified by the indentor, the finished mirror shall be subjected to the humidity and corrosion tests given in **6.7**. At the completion of these tests, the mirror shall show no evidence of corrosion or pitting.

NOTE — Unprotected mirrors do not withstand salt spray and humidity.

5.6 The optical thickness of the film which protects the aluminium coating shall be one-half wavelength for 550 nm.

5.7 Finished mirrors shall be capable of being cleaned when washed with neutral soap solution or neutral detergent solution free from grit.

5.8 The finished mirror shall show no evidence of water stains on the surface.

6. TESTS

6.1 The mirror shall be free from blisters and greasiness. While looking at the mirror against light incident at a steep angle, no film shall be observed and there shall not be any change in colour while the angle of incidence is altered.

6.2 Pinholes shall be checked by looking at the mirror held against a filament of 250 W incandescent lamp.

6.3 The mirror shall be reasonablv free from pits, pinholes, scratches and sleeks depending upon the requirements of quality. Pits and pinholes, 0.1 mm or less in diameter, through the aluminium coating, shall not be a cause for rejection provided the total number does not exceed proportionally 2 percent per 650 mm^2 or portion thereof. Imperfections outside the free aperture of the mirror shall not be a cause for rejection.

6.4 Reflectivity — This test shall be carried out with the aid of photometer. When a mirror is positioned at an angle of 45° the reflectivity value shall not be less than the value specified in **5.1**. The method recommended for this test is as under:

> The source of light to be used (*see* Fig. 1A) shall be illuminant C. Illumination is recorded on the photometer when instrument is set as in Fig. 1A and is adjusted to read 100 by adjusting an iris diaphragm. The front surface of the mirror under test is then placed on the table at 45° to the ray of light from the source (Fig. 1B) and the photocell arm turned at right angles to receive the reflected beam of light. The percentage of reflectivity is read by the photometer directly.

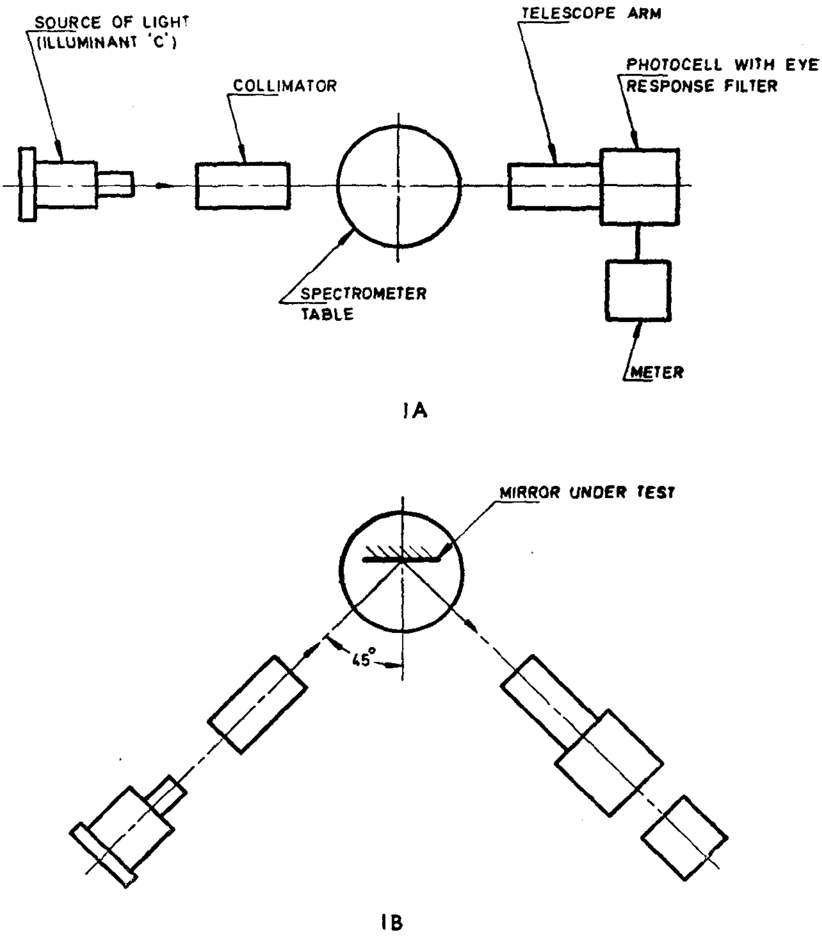

FIG. 1 ARRANGEMENT FOR DETERMINING REFLECTIVITY

6.5 Hardness Test — This shall be done as given in **7.8.1** of IS : 988-1959*.

6.6 Adherence Test — This shall be done in accordance with clause **7.2** of IS : 988-1959*.

---

*General requirements for optical components.

6.7 Climatic and Durability Tests — The tests as specified for Class B-1 mirrors in Appendix B of IS : 7011-1973* shall be conducted on mirrors with protective coating. The corrosion test, however, shall be conducted as under:

> The mirror shall be placed in a thermostatically controlled cabinet with a salt atmosphere for 4 hours at a temperature of 35 ± 2°C. The salt atmosphere shall be obtained by allowing a stream of air to bubble through a salt solution containing 27 g of sodium chloride per litre.

NOTE — These tests shall be carried out on a small percentage of mirrors selected at random or as specified by the indentor.

6.8 Film Thickness — Film thickness of the protective coating shall be measured by the help of a standard interference microscope on a standard test piece.

6.9 Cleanability Test — The finished surface of mirror shall be able to withstand cleaning when done in accordance with **7.8.2** of IS : 988-1959†.

6.10 Liability to Stain — No stains shall be observed when treated in accordance with **7.8.3** of IS : 988-1959†.

6.11 Surface Accuracy — The surface accuracy shall be checked by interferometric method.

7. MARKING

7.1 The mirrors shall be marked at a suitable place with the manufacturer's name or trade-mark.

7.1.1 The mirrors may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

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*Specification for back-silvered mirrors used in instrument industry.

†General requirements for optical components.

8. PACKING

8.1 The mirrors shall be suitably packed in carton as shown in Fig. 2 in such a manner that the reflecting surface is not touching the wrapping material. The carton shall be further overwrapped in acid-free tissue paper and cotton.

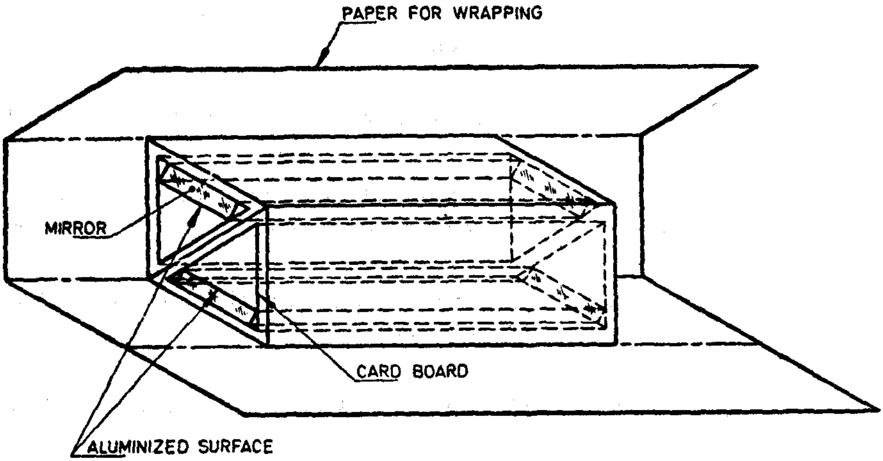

FIG. 2 PACKING OF MIRRORS